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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/777,076	02/05/2001	Miklos Stern	7157-210	9554

156 7590 02/11/2008
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EXAMINER	
LE, THIEN MINH	

ART UNIT	PAPER NUMBER
2887	

MAIL DATE	DELIVERY MODE
02/11/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/777,076	STERN ET AL.	
	Examiner	Art Unit	
	THIEN M. LE	2887	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/16/2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *235-257* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *235-257* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 September 2001* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

The amendment filed on 11/16/2007 has been entered. Claims 1-234 have been canceled. Claims 235-257 are presented for examination.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 235-247, drawn to the apparatus and method claims 252-257, are rejected under 35 U.S.C. 103(a) as being unpatentable over Neukermans et al. (Neukermans et al. – 5,629,790; herein after referred to as Neukermans; cited previously) in view of Peng (Peng - 5,555,125).

Regarding claims 235, 242 and 252, Neukermans discloses a dataform scanner comprising: (i) a laser diode; (ii) at least one scanning mirror wherein the scanning mirror is a micromachined mirror. The claim differs from calling for a scanning mirror and a stationary detector. However, this claimed limitation is not new. Reference to Peng is cited as an evidence showing a polygon scanning mirror 31 and a stationary detector 9. It would have been obvious to incorporate a micromachined-mirror as taught in the system by Neukermans in the a scanner system wherein a stationary detector is required. The modification merely extend the applications of the micro-machined scanning mirror does not require to move together with the detector.

The following quotes from Newkermans that are relied upon are herein provided for further reviews:

> In FIG. 2a, the electrodes 142 and 144, corresponding to electrodes 41 and 43 in FIG. 2, are shown on an insulative substrate 45. The larger wafer section has opposite sides 131 and 133 which are disposed on the glass substrate 45 and have a rectangular shape similar to the section 31 of FIG. 2. The mirror 135 is supported by torsion bars from the larger silicon section in a position spaced above the electrodes 142 and 144. Above the sides 131 and 133 at the larger silicon frame is a portion of a second wafer having opposed edges 141 and 143. Optionally, the edges 141 and 143 support a vapor deposited very thin membrane window 145 (or any transparent window) if a sealed container is desired.

(7) The entire structure is fabricated using semiconductor processing techniques. Atop the dielectric substrate 45, the electrodes 142 and 144 are vapor deposited metal stripes which are patterned on the silicon dioxide coating on the substrate 45 using standard photolithographic techniques. The silicon section having sides 131 and 133 and the integral mirror 135 are separately fabricated by anisotropically etching a silicon wafer. Only opposed torsion bars support mirror 135. The micromachined silicon housing described above is preferred, but not necessary. A conventional box with a transparent top could also be used. When a membrane window is used, the window is made sufficiently tough so that transparent electrodes may be deposited directly on the membrane. With reference to FIG. 2b, electrodes 142 and 144 are very thin indium tin oxide stripes deposited on window 145. The stripes may be only a few molecular layers in thickness because very little current is conducted by the electrodes.

(8) The thickness of the mirror 12, 33 or 135 may be equal to the thickness of the wafer, or less. For high frequencies of operation, the mirror thickness is typically a fraction of the wafer thickness. Mirror thickness may range from less than one micron to tens of microns. The preferred method of manufacture, involves use of a Simox wafer, or similar wafers, e.g. silicon on insulator substrates, where the mirror thickness is determined by an epitaxial layer. Single crystal silicon is preferred both for the mirror and the torsion bars because of its superior strength and fatigue characteristics, as compared to metals or polysilicon. For low frequencies of scanner operation, typically below 100 Hz, if the mirror's thickness equals only that of the epitaxial layer, then the length of the torsion bars makes them too fragile to withstand liquid processing or shock within their working environments. The full thickness of the wafer's epitaxial layer should be used to form the torsion bars in this situation. The torsion bars would now be much broader and shorter, but their thickness would still be set by the epitaxial layer's thickness. However, the mirror would be much thicker equaling the total wafer thickness depicted in FIG. 3a. The wafer about the mirror's mass around the center can be mostly etched away producing a box frame structure such as that illustrated for the frame 207 depicted in FIGS. 12a and 12b. This affects the resonance frequency very little, as well as the moment of inertia, but reduces the mass of the mirror and hence the forces on the torsion bars. Construction of the thicker section is explained below with reference to FIG. 3a.

(9) Once completed, the larger structure has a light transmissive window mounted above the scanning mirror. This is done by taking a second silicon wafer and vapor depositing a layer of silicon nitride, silicon carbide or boron nitride over the wafer and then etching away the supporting wafer down to the thin vapor deposited film. A thin layer of Si could also be used. The edges 141 and 143 are sides of a second wafer structure joined to opposing edges 131 and 133 of the larger section of a first wafer structure. The two congruent wafer sections are joined by a variety of processes such as anodic bonding, silicon to silicon bonding, solder glasses, etc. all done in a vacuum environment. This creates vacuum conditions inside of a closed container. The method of manufacturing the thin window 145 is described in U.S. Pat. No. 4,468,282 to A. Neukermans. The patent describes thin films having a thickness in the range of a few microns. The area of the window for a micro scanner would be about 3 mm.times.3 mm. The advantage of such thin films is that

optical aberrations are eliminated. The film which is selected should be substantially transmissive of light, with little absorption so that the film will not be damaged by an incident laser beam. By providing a vacuum container for mirror 135, damping due to air is eliminated and the mirror will oscillate to frequencies ranging up to several tens of thousand hertz. It should be noted that a vacuum enclosure is not necessary, but greatly helps in reducing the voltage needed for electrostatic drive, as well as for magnetic drive. Because the micromachined mirrors are difficult to clean, a dust cover is preferable. The windows, in a non-vacuum environment, serve as a dust cover. Large electrostatic voltages attract particles to the surface of the mirror and so the enclosure serves several purposes.

(29) FIG. 12b shows the construction of the two-dimensional scanner. An insulative substrate 221 is coated with a pair of stripe electrodes 223 which are slightly spaced from the first silicon frame member side walls 207a and 207b. The inner silicon frame is spaced from the outer silicon section by the torsion bars 209 connecting with side wall members 211a and 21lb. The inner mirror 203 is supported from the same silicon member as the frame 207 and the outer section 211 but is thinned in the manner previously described in order to achieve low mass. Driver electrodes 225 are supported from overhang regions in the manner described with reference to FIG. 2b. The overhang regions and thin film window associated with a container for the apparatus are not shown. Building of torsion sensors, diode leads, magnetic coils and the like requires a fairly large number of leads going over the torsion bars. It is possible to sense the resonance condition of mirror 203 on torsion bar 209; oscillation of mirror 203 causes uniaxial stresses in torsion bar 209, which can be sensed with the usual uniaxial piezo sensors built into torsion bar 209. This arrangement requires fewer leads.

(30) In vacuum, because of the absence of viscous damping, the Q of the device becomes extremely high. Q's close to 700,000 have been measured in a vacuum of 2.times.10.sup.-6 Torr, for a device which had a Q of 20 at atmospheric pressure at 810 Hz. A few volts is then all that is required to power the device with an electrostatic drive. This low voltage makes shielding of other peripheral devices, such as the electronics circuits for the torsion sensor or photodiode array much easier to accomplish. The Q (or the damping) of the resonator can be readily adjusted by changing the ambient pressure in which the device operates. Because the required power for oscillation is so low, one can envision a solar cell on the same piece of silicon, providing power required for the torsional oscillator. Such a power supply could also power a laser diode of a scanner for short periods of time. In this manner, the scanner of the present invention would not require any external power supply.

(31) The micromachined scanner of the present invention is so light that it can be carried by a conventional scanner in a second, usually orthogonal axis, without any problem. Thus, a conventional scanner would provide scanning motion in one axis, say x-axis, while the scanner of the present invention would provide scanning in an orthogonal axis, say y-axis. The conventional scanner, which might be a galvanometer scanner, would operate at a lower frequency and the micromachined scanner of the present invention, which would contain the scan center, would operate at a higher frequency.

(32) Using two dimensional scanning, together with a modulated diode laser, it is possible to make simple and inexpensive displays. For example, a very high frequency scanner can be made, by operating the micro scanner in vacuum. For example, using a 10 micron thick mirror, 800 micron square, with torsion bars 20 microns wide and 200 microns long, the resonance is on the order of 15,000 Hz. This is about equal to the horizontal sweep frequency of a television display (15,750 Hz). Hence, a mechanical scanner, oscillating at 60 Hz (driven by the line frequency) carries the very fast scanner in the other direction. Together they present a very inexpensive system capable of displaying television images on a phosphor screen with a 2:1 interlace. If the resonance frequency of the lower scanner is higher (say 120 Hz) for ease of operation, then a 4:1 interlacing scheme needs to be used to obtain 30 frames a second. No electron beam is used. The x and y drives are preferably linear, rather than sinusoidal drives, using a magnetic drive and the torsion sensor. Four terminal piezosensors have been suggested as angle sensors for self-oscillation. Capacitive sensors have been used for self-oscillation, (R. N. Kleiman et al., Rev.Sci.Instrum., vol. 56, 11, 1985), because they are less expensive. When the oscillator is enclosed in a vacuum box, capacitive sensors may be preferred, because no leads need to go through the vacuum package. Well known micromachining techniques exist for providing corrugations around the mirror periphery. This enhances mirror flatness greatly, while affecting the mass very little.

Regarding claim 236 and 243, see the discussions regarding claim 235 and figures 9-11 of Neukerman

Regarding claims 237-241, 244-247, and 253-257, see the discussions regarding claim 235. Neukerman discloses that the scanning mirror is made of silicon, connected to a silicon substrate, and are driven electrostatically and by torsional hinges. The following quotes are herein provided for further reviews:

ABSTRACT:

A frequency-locked torsional scanner of the type having a micromachined mirror formed on a surface of a silicon wafer section supported within a larger wafer section by a pair of opposed torsion bars. The principal vibrational frequency of the mirror is selected to be at least 20% higher than other modes of vibration. To prevent breakage, the torsion bars are hardened by conversion of at least a surface layer to silicon carbide or nitride. A pair of scanners with orthogonal torsion bars may be mounted in a vacuum enclosure for two-dimensional scanning at different rates suitable for television display. In alternate embodiments, a detector and a scanner may be built on a plate on the same supported wafer section or two scanners may be independently supported or one scanner and one detector may be independently supported as two plates. The mirror may be driven electrostatically, magnetically, or by both methods.

(6) FIG. 1, depicting a scanner shown in FIG. 39 of Peterson, Proc. IEEE, supra, p. 61, includes a micromachined torsional mirror 11, supported by torsion bars 13 and 15 within silicon body 17 ("micro scanner" hereafter). The aforementioned article describes typical mirror parameters, such as the modulus of silicon, the typical wafer thickness, the length of the torsion bar and the dimensions of the mirror. The width of the torsion bars is on the order of 500 micrometers, while the length of the torsion bars is approximately 0.2 centimeters. The mirror is approximately 0.22 centimeters on a side. The cut which isolates the mirror from the silicon body and also defines the torsion bars is approximately 0.02 centimeters in thickness. Each cut is made by anisotropically etching the silicon. The silicon body rests on glass substrate 21 which has vapor deposited electrodes 23 and 25. A depression 27 is etched into the glass to receive silicon body 17 which rests on a linear support ridge 29. A high voltage is applied first to one electrode then the other in a continuing out-of-phase sequence from a drive circuit. The electric field generated by the electrodes tilts the mirror first to one side and then the other. The restoring force of the torsion bars works against each deflection. The resonant frequency of the mirror can be calculated with well known formulas cited in the above-mentioned articles, although air damping creates an error in the resonance frequency. The substrate, electrodes and drive circuit are part of the micro scanner.

Claims 248-251 rejected under 35 U.S.C. 103(a) as being unpatentable over Neukermans et al. (Neukermans et al. – 5,629,790; herein after referred to as Neukermans) in view of Peng (Peng - 5,555,125) and futher in view of Dobbins et al. (Dobbins et al. – 4,727,245; herein after referred to as Dobbins).

Regarding claims 248-251, see the discussions regarding claims 235-247. The claims differ in calling for a handheld scanning device having an interface module, and/or a keypad. However, this claimed limitation is not new. Reference to Dobbins is cited as an evidence of the conventionality of the a laser bar code scanner having a keypad, an interface, and hand-held supportable housing. Without any expected result, it would have been obvious to incorporate the teaching of Neukermans-Peng' scanning device in the environment that require hand-held construction in the manners as

disclosed by Dobbins. The modification is merely within the skilled levels and expectations of an ordinary skilled in the art in light of Dobbins' teachings.

Remarks

Applicant's arguments and amendments filed on 11/16/2007 are considered persuasive but are rendered moods in light of the new grounds of rejection. Since applicant's amendments to the claims necessitated the new grounds of rejection. This Action has been made Final.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thien M. Le whose telephone number is (571) 272-2396. The examiner can normally be reached on Monday - Friday from 7:30am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael G. Lee can be reached on (571) 272-2398. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Thien M. Le/
Primary Examiner, Art Unit 2887